Carbon nanotubes grown on oil palm shell powdered activated carbon as less hazardous and cheap substrate

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APPLIED NANOSCIENCE
Volume: 8 **Issue:** 7 **Pages:** 1767-1779
DOI: 10.1007/s13204-018-0861-2
Published: OCT 2018
Document Type: Article
View Journal Impact

Abstract

Multiwall carbon nanotubes were synthesised using fixed catalyst in a chemical vapor deposition reactor. The reactor system was locally built and used to grow carbon nanotubes (CNTs) on oil palm shell powdered activated carbon (PAC). The PAC was impregnated with Fe3+ catalyst through sonication process. The nano-micro composite produced in this study was named as "CNT-PAC". Acetylene (C2H2) gas was used as carbon source compared to the use of toxic hydrocarbons such as benzene (C6H6). Synthesis parameters such as gas flow rates, temperature and reaction time were varied for high yield of the CNTs on powdered activated carbon. The CNT-PAC samples were characterized using field emission electron microscope and transmission electron microscope to confirm the growth of CNT as well as to study the morphology of the nano product. Selected well-grown CNT-PAC were further characterized using Fourier transform infrared spectroscopy, thermal gravimetric analysis and BET surface area measurement. The results showed that BET surface area was improved from 101.1 to 974.9 m(2)/g. The Zeta potential was - 46.1 mV. The zeta potential of the nano-micro composite indicated that the material will be in good dispersion in aqueous solution. The CNT-PAC product was also oxidized using KMnO4 to functionalise various radicals on the surfaces. The product could be potential as an adsorbent for gaseous and aqueous pollutants due to its high surface area and the presence of various functional groups.

Keywords

Author Keywords: Adsorbent; Catalyst impregnation; Chemical vapor deposition; Functional groups; Nanotechnology; Powdered activated carbon

KeyWords Plus: CHEMICAL-VAPOR-DEPOSITION; FLOATING CATALYST METHOD; AQUEOUS-SOLUTIONS; NANOFIBERS; DECOMPOSITION; ADSORPTION; IONS; REMOVAL; CHEMISTRY; ACETYLENE

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Funding

Funding Agency	Grant Number
Ministry of Higher Education (MOHE) of the Government of Malaysia	FRGS 0106-42

View funding text

Publisher

SPRINGER HEIDELBERG, TIERGARTENSTRASSE 17, D-69121 HEIDELBERG, GERMANY

Journal Information

Impact Factor: Journal Citation Reports

Categories / Classification

Research Areas: Science & Technology - Other Topics

Web of Science Categories: Nanoscience & Nanotechnology

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1 of 1

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